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INDUSTRIAL EDUCATION, THE WORKING-MAN, AND THE SCHOOL

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The education of a workman has always been very close to his trade. The dependence of his training upon his trade is expressed in the word apprenticeship. The apprentice has been trained by helping under the direction of a master in the trade. If we go back far enough we find apprenticeship as a necessary introduction to every trade, and indeed the only introduction. The elementary school appeared in the first place to train the clerk and accountant. It was part of the apprenticeship of the commercial trades. In the seventeenth and eighteenth centuries the artisans and laborers were not taught to read, write, and figure. The extensive commercial activity, the constantly increasing use of money, and the growing importance of reading for political and social life, gradually carried the demand for control over the three R's throughout the whole laboring class; though it remained for America in the early decades of our republic to inaugurate the common school with universal education. Under these conditions, the master artisan was expected to allow his apprentices to attend the common schools, but there was little or no connection between the schooling and training in the trade.

The school taught the use of language and number. Apprenticeship taught the vocation. It was true that the exercise of the trade demanded reading, writing, and figuring, but the apprenticeship system simply left training in these to the school. The two vehicles of education remained separate and influenced each other either indirectly or not at all.

This was partly due to the function of the common school in America. It opened the door to all avenues. Our democracy elected men to office who had no more than a common school education. It is not very long ago that boys left the common

school to read law and medicine. In a country in which everything was open to everyone and the common school was the door to all opportunities, the relation of schooling to the work of the apprentice was lost in its relation to more ambitious callings. The common school has retained its stamp of the first step toward the learned professions and political preferment.

Thus the education of the workman has been and has remained divided into two parts, the formal training in the three R's and the apprenticeship to a trade. These two parts have not been parts of a whole. The schooling has remained formal, bookish, and literary in its interest. The apprenticeship has suffered severely in the change of modern industry, but even in its better days it did not awaken any interest in its own history, nor in its social conditions, nor in the technique of better methods. The schooling taken by itself was narrow and unpractical, the apprenticeship had no outlook and wakened no interest outside itself. The two did not reinforce and interpret each other. In a certain sense they ought to have been in the relation of theory and practice. The apprenticeship should have presented the problems which the school solved, and the interest in the solution of these problems should have made the work of school vivid and educative. But while it is easy to pick flaws in this training, its results were admirable especially in comparison with the training which children of today get who work with their hands.

Apprenticeship remains in many trades, especially in those under the control of organized labor. The interest of organized labor has been, however, very largely that of keeping down the number of skilled artisans to that which the trade can profitably absorb. Organized labor has not accepted the control over apprenticeship to make out of it a better education. Nor is there uniformity in the trades. In many the apprenticeship system has quite gone by the boards, in others it is not at all adequate. As a system of training skilled laborers the old system of apprenticeship has disappeared and no consistent new system has arisen to take its place. The cause of the changes is evident enough. It is the machine that has taken possession of the trades, has displaced the artisan, and has substituted for the artisan, who

makes an entire article, a group of laborers who tend the machines.

The effect of this upon the training of the laborer has been most deplorable. The more the machine accomplishes the less the workman is called upon to use his brain, the less skill he is called upon to acquire. The economics of the factory, therefore, calls for a continual search for cheaper and therefore less skilled labor. The success of the modern type of wholesale manufacture of inexpensive goods has depended upon the vast numbers of unskilled laborers. Women and children have been swept into the factories to displace the more expensive labor of men. We are accustomed to recognize that the sudden use of this type of factory production was made economically possible by the huge markets which steam transportation brought to the doors of the factory. The other determining factor, the surplus of unskilled labor that could be absorbed by the factory and the mine, we are not so conscious of. We are also very well aware of the nicety with which the inventor can adjust the machine to a product which the market demands. We are not so aware of the equal nicety with which the inventor adjusts his machine to the cheapness of labor.

The most serious handicap under which labor suffered with the opening of the modern period of factory industry was the lack of any connection between the training of its apprentices and the technique of the machine. The intelligence of the artisan who made the whole article made of him an admirable citizen of the older community. It was this intelligence very largely which made the success of our early democratic institutions. The apprenticeship system made practical, intelligent, self-reliant men, as well as good workmen who did not have to blush for the work of their hands. The training was not, however, adaptable. The very skill of the artisan stood in the way of his adapting himself to the new régime. The skilled artisan was no more but rather less valuable than the untrained man. And machines invented to exploit unskilled and unintelligent labor in so far fixed the condition of the workman that were thereafter to tend these machines.

It is perhaps idle to speculate as to what the form of the machine, and the method of industry would have been if the laborer had had the training, the science, and the sort of skill which enabled the merchant, the manufacturer, and the engineer to make use of the advent of steam in manufacture and transportation; but we can recognize that invention has shown a suppleness in adapting itself to any kind of product or market, in using every sort of science and technique, and that there is every reason to believe that adaptable intelligence, skill that could be generalized and applied in various ways, if found at that period in the artisans, would have been a more profitable field for invention than the lack of intelligence and adaptability which our present machines are built to use and exploit.

A skill that can be adapted must be based upon some theory. The shop must be reinforced by the school. Such skill can turn from one form of manufacture to another, as the manufacturer himself can turn from sewing machines or steam locomotives to automobiles. Such dependence of the shop upon the school, of practice upon theory, we find in our most up-to-date apprenticeship schools. In those of the General Electric Company, of the New York Central Company, of the Houston, Stamwood, & Gamble Company at Cincinnati, the schooling represents by and large a half of the preparation. The apprentice must understand the technique that he acquires so that he can apply it with intelligence, and this means power to do many things, not one thing alone. It means the creation of intelligence rather than speed in the apprentice. These apprenticeship schools will not allow the foreman to hold the apprentice to a machine because he operates it with greater speed, i. e. : these schools recognize that the man must not be subordinated to the machine if he is to acquire the sort of skill they wish in these upper class workmen. The school and the shop must go hand in hand in modern artisan-ship. Their lack of connection in the old system spells the disappearance of the old-time system as the old-time artisan has disappeared. There can be no question that the modern artisan demands schooling if he is not to be a mere creature of the machine. He needs the mathematics and drawing out of which

the machine has arisen. He must know the formulas which are expressed in the tools that they may be his tools and adapt them to his uses. He must be able to read the blue prints that are the language into which the engineer translates the formula to carry it over into bodily form. This sort of training is the only kind that will free the artisan. It is not until he can comprehend the machine as a tool that he will not be a part of it. Not that the employer desires in his high laborers ignorance. He is building up expensive schools because skill here is money in his pocket. The history of the technical schools at Fall River, Massachusetts, demonstrates that the employee, the employer, and the community all recognized the need of this training in the artisans who were to employ the high-grade machines.

It is in the economic struggle that organized labor fears the apprenticeship school. It has fought to keep down the number of apprentices in order that their wages might be kept up, and their working hours more occupied. Industry being organized on the basis of surplus labor supply, it is natural that labor should suspect the employer of aiming to bring about a surplus of skilled labor not only to make sudden increase in production possible, but to enable the employer to fight the labor union. That many employers have this in view is of course true.

However, as long as advance in wages means skill there will be an inevitable demand among laborers for industrial training. Correspondence schools are profiting by this demand at present, at the expense of the laborer. In the end it would be hopeless for labor to maintain its economic position by entrenching itself behind lack of skill. If the apprenticeship school is the best method of learning the trade it will be adopted. The restriction of the number of apprentices must arise in some other fashion, for with these schools, whether in the hands of employers or in our public-school systems the numbers cannot be fixed by the labor unions, and skilled labor outside the union will be more dangerous than inside the organization. Inevitably the manner in which the commodity of skilled labor is to be controlled will be changed. It will be controlled because it is an economic waste to the country to have a surplus of labor. Our present industries

adapt themselves to this surplus and of course exploit it, but this does not in any sense justify it nor make it permanent. Industry has adjusted itself to and exploited child labor. The remedy for this exploitation is not to be found in reducing the birth rate, and thus the number of children. The community itself, becoming intelligent, refuses to permit such economic and human waste as that involved in child labor. It must reject as decisively a system by which industry drops its adult labor into misery when for the time being it is not needed, to pick it up again at a reduced rate when there is a demand for increased production. The social control we demand will come through increase in intelligence, and the laboring class is the last class that can afford to restrict its own intelligence. In our present industrial evolution the race is to the technically equipped or to those who can command such equipment, and in a competitive society those who lack such equipment must be subject to exploitation.

The tremendous revolution brought about by the factory system, the machine, has found every group in society equipped with sufficient free intelligence to enable them to adapt themselves to the changes incident to the revolution. The investor, the producer, the middle man, the technical expert, the engineer, the banker, fitted in with no friction with the new order and have profited financially. The capital of the artisan alone has been lost. His capital is his acquired skill. If this is simply in the form of a fixed group of habits every change in the method of manufacturing will consign workmen to the human scrapheap.

The financial disability of the laborer is that which is generally contrasted with the greater freedom of the capitalist or those who can accumulate a financial reserve. A revolution in industrial methods may annihilate the investment of the capitalist and even wipe out of existence the occupations of officers and employees. Still those whose incomes have permitted the accumulation of a reserve have an indefinitely better chance of getting upon their feet again, than have those whose incomes admit of no accumulation. There is room for them in which to move. They can seek opportunity at a distance. They can wait for it. They can prepare themselves for new and

unaccustomed occupations, while the laborer whose income is swallowed up day by day in the necessary outgoes for his and his family's daily bread, must do anything or nothing as it presents itself, at the moment, at his own door. There is no reason to depreciate this disability of the day laborer. It only emphasizes the other disability which has been above presented; the disability of skill without adaptive intelligence. The man who knows why he does what he does, is better able to do something else. Intelligence, the ability to see the relation of means and end in conduct, is the fundamental form of freedom—"and the truth shall make you free." A laborer with acquired skill for which he has no theory, approaches the condition of the purely instinctive animal. He becomes helpless the moment he is out of the environment to which his habits are adapted.

To these general propositions, which may be summed up in the old adage that knowledge is power, a reply comes from our technical schools and our universities. It is said that only a select few can afford to know; that our life has become so complicated that it must be governed by the highly trained expert; that it is the age of the expert who dominates our industry as really as he does our medical practice. And there are social philosophers willing to accept this judgment and build their conceptions of the future of society upon it. We are, according to them, to pass from the control of the political and financial aristocracy to that of the technical expert. Only they will be able really to understand why anything is done in the growing complexities of our society, and they will rule. And the answer to this philosophy is that the expert does not and in human history has not ruled. He has served. His greatest effectiveness is found among those who are intelligent. The expert even in industry demands not blind obedience but intelligent co-operation, and the more intelligent the co-operation can be, the higher the efficiency of the expert. What is wanted in an ideal machine shop, where the tools are made to do certain work, is that the man who uses the tools should be able to criticize the tools. He should be able to go to the man who planned and made them and tell him how they work and where the test of use shows that they fail and need to be improved. If

human intelligence consisted in the knowledge of fixed laws and methods the man who knew them would be king. It consists in the constant interaction of theory and practice. Theory is called in to tell us how to act, and what we do shows us where the theory was defective. As long as we have got to check up and reconstruct our theories, our plans, our models by their working, there is going to be as great need of intelligence in those who use the tools, who install the machinery and fit the pipes, as in those who think them out and make the blue prints. No one can estimate the loss which our industry suffers from the lack of trained intelligence among the workmen. The loss arising not simply from injuries and wear and tear due to ignorance, but from the suggestions of inventions that have not been made, from the opportunities for saving and for increased efficiency of equipment that have not been used can never be estimated. The exploitation of ignorance and misery which is involved in machines tended by the unintelligent, the children, the physically and mentally unfit represents losses none the less real because they are not recognized. Any process that adjusts itself to the lack of intelligence is in just so far wasteful—if it might be served by intelligence. If human invention has been able to make use of the ignorant and stupid, it certainly could have adjusted itself the more to those who were informed and skilful.

There is nothing more democratic than intelligence, because the higher the intelligence the more it demands of others for its own best exercise. It is true that intelligence may be used to manipulate brute matter, and brutalized men, and it may so adjust itself to this task that it conceives its function is to use the unintelligent. Those who possess it may conceive themselves an aristocratic class apart, but this only indicates their false and inadequate conceptions. When intelligence goes into action of any sort it demands all the intelligence it can find. It seeks comprehension in its agents; because it never can keep tab upon itself; it can never adjust itself and its constructions to their purposes without working with people who are in so far on a par with itself that they can judge the workings of the machinery and the execution of its plans.

This needs to be emphasized not only to make evident the importance to society of the widest possible spread of intelligence and the fact that industry can afford to pay for it, but especially to indicate the nature of the intelligence and the manner in which it should be acquired. It is the sort of intelligence that is close to its application. Its results are the criticism of methods and means as well as their use, and the suggestions of improvements and economies. This calls for an interest in theory just as far as that is involved in understanding what is being done. Many of our best mechanics get it without going to technological schools. They find out what they need to know and get the textbooks, the formulas, the tables that are necessary for this purpose. It is a result to which many a more ambitious education reduces itself in practice.

It is just the type of education which higher apprentice schools in this country and in Europe give to those whom they expect to be the élite of their workmen. It involves a knowledge of a whole process, if one is to comprehend any part of it. Thus in the approved apprentice school a boy may not be held to a single machine to merely gain speed. He must be familiar with all the machines. Mathematics and drawings are necessary for such a training, at least as far as the control over them helps on with his task. A large part of mathematics is a language in which one can best state his problem. If his work brings problems with it the workman must have the appropriate language in which to state them. It is also a language in which the results of the work of others can be conveyed in the form in which they will help toward the solution of the problems. The same thing can be said of the blue print. The competent workman must be able to read his tables, his formulas, his blue prints. It is fair to assume that any workman who has had the right training can reach this goal. It is important to notice that so much theory as this does more than make an expert workman in a definite calling. It also gives the skill he possesses adaptability and pliability. When he has met problems and has solved them in his own occupation he gains a confidence in his ability to solve the problem brought by a change of occupation. Theory after all is

nothing but the consciousness of the way in which one adjusts his habits of working to meet new situations. The man who has never made such readjustments is discouraged at the mere presence of the new situation. The man who has done it, who has some acquaintance with the processes and technical expressions by which it is accomplished has his interest aroused by the new situation. The acquaintance with, and use of, so much of the theory of an occupation as the exercise of the man's own function in it calls for, means that his habits are not fixed, that the man has an adjustable nature. His chances of fitting into a new economic situation are a hundred times better than those of the man who has simply the facility of a single process. In the exigencies of the shop such a man can pass from one machine to another. His speed is not at first what it will be when his reactions become almost automatic, but the knowledge which he has of the whole process and the ability he has of stating the new and the old jobs in the same terms render him a vastly more valuable man than the workman who is nothing but a part of a single machine. The amount of training which an operative, a workman, in any trade should have is that which will acquaint him with all the processes of his trade, and so much theory of his trade which will enable him to understand the tools he uses and the manner in which they operate, that he may both use the tool to the best advantage and be able to check up its efficiency and suggest the sort of changes and improvement that should in his judgment be made.

So much training a mechanic, a farmer, a mill operative, a plumber, every artisan should have. In the bill of rights which a modern man may draw up and present to the society which has produced and controls him, should appear the right to work both with intelligent comprehension of what he does, and with interest. For the latter one must see his product as a whole, he must know something of the relation of the different parts to the whole, and he must know enough of the language in which the problems of his trade are stated and solved to be able himself to criticize his own work and his own tools. This indicates also the manner in which this training should be acquired. The

apprenticeship school in which school work and shop work balance each other, in which the school provides the method of stating and meeting the problems which arise in the shop, has become the modern system of apprenticeship. As we have seen, it is distinguished from the older apprenticeship system by its school, and from the later system by the organic relation between the school and the shop. The school work commands attention because shop problems appear there. And the shop becomes educative because its processes are comprehended and thought out. This educational method is ideal from the psychological point of view, for the acquirements of the school are demanded by the practical activities of the boy. This result has never been attained in other public or private schools. The training in these schools has been planned largely with reference to occupations which are not to be undertaken until the pupil has left school. Hence language and number have been dry formal studies meaning little or nothing to the child.

Some schools have attempted to meet this difficulty by introducing what have been called constructive activities in the school, so that the problems of the children might be real problems. The measurements of the boxes they were making should give them their arithmetical problems. In solving the problem they would also be learning what amount of lumber they would need and what lengths they would have to cut off, etc.

With this in view, very varied activities have been introduced in certain private schools. The results have not fully met the anticipations. The children's work has not felt the compulsion which apprenticeship offers. The actual products of the factory set not only problems but they carry with them a discipline that the apprentice accepts. They set the standard which becomes the boy's standard because he wishes to succeed in his calling. No task which the child sets to himself, and no task which the school sets as a school, has this meaning to the child. His own task makes no demand upon him that is bigger than himself and sets no standard that comes upon him with compelling power from the great world of which he wishes to be a part. No tasks of a school can be made to take hold upon the child as the training does

which is to admit him to the rank of men. Even in college the students will not work as they will in the law and medical schools where they get their professional training.

In an industrial democracy the citizen must sufficiently understand the tools and the processes to comprehend and criticize the tool and its use. This is not only necessary for the technical efficiency of the industry. It is equally essential for the social control of the conditions of labor. At present the workmen undertake this by controlling labor as a commodity in the market. The artisan has lost the vantage-point of the mediaeval guild. Their control was over the product and the process. It is neither possible nor desirable to reproduce the mediaeval guild. It is possible and logical to make the workman's skill the basis of his social position and financial competence. Where labor appears only as a commodity, the unit being any man, the group of laborers can protect their wage only by protecting the weakest man. His wage must be theirs and it follows that their individual outputs must be his. On the other hand, the more highly skilled workmen tend to get out of the unions because on the one hand they do not need its protection and on the other their own earning power is restricted. Or the unions of the more highly skilled trades are able to pursue so different a policy in protecting their wage and hours of labor, that they lose touch with the unions of less skilled labor. This break emphasizes the attitude of the unions of the relatively unskilled trades. It is of the first importance that the working-men recognize that skill—developed intelligence—brings an entirely different factor into the economic situation, from that of the so-called supply and demand of a commodity. That other factor is described somewhat vaguely as the standard of life. It is recognized in the higher salaries of skilled employees—of professional men. When you demand skill you must make possible the conditions under which that skill can be obtained and exercised. Those conditions involve not simply technical training. Intelligence depends upon conditions of physical and social well-being. Every new demand for skill will inevitably carry with it the conditions under which that skill can be obtained. The manner in which a community

responds to this obligation will be varied, and will appeal to many motives beside the economic interests.

There is no community in which a more conscious demand is being made for larger skill on the part of its workmen than Germany. There is no community in which society has faced more definitely the necessity of raising the standard of life of its working classes. State insurance seeks to meet the unavoidable accidents and disabilities. Supervision of hygienic conditions undertakes to eliminate the evils to which economic inferiority exposes great masses of men. Universities and schools of every character aim to put the intelligence of the laborer upon the higher level demanded by the self-conscious industry of Germany. And Germany has but begun to recognize the consequences which will follow with unavoidable logic upon her demand that her laborers be adequately instructed. Society cannot demand intelligent workmen without accepting the policy of rendering the acquirement of such intelligence socially possible. What the laboring classes have to fear, at least for the immediate future, is that the demand for skill will be too restricted; that our community will conceive that it can fulfil its industrial functions with an élite of trained workmen and a proletariat of the ignorant and unskilled. If organized labor can raise its eyes for the moment beyond its immediate quarrels with its employers, it will recognize that its most strenuous efforts must be directed toward the widest possible industrial education, and that this demand must be made on behalf of all labor.

There remains the school itself. The apprenticeship system, as it has been worked out by the General Electric Company, is pedagogically and technically admirable. It is possible and probable that such schools will be multiplied among large concerns throughout the country. But even with such extension of the system the demand for this apprenticeship will not and cannot be met. Every laborer who is going into mechanical industry or into allied trades should have this training. It will be a training, if we may judge from the experience already gathered, which will accomplish its task of instruction as the public schools have never been able to fulfil theirs, for it will, under proper condi-

tions, draw upon the interest of all professional training, and it will always have the discipline which contact with the actual process and product brings with it.

Such training cannot be confined to those whom our great industrial companies educate for their shops and designing rooms. It must be the demand of labor that this system of apprenticeship training be taken into the public schools. Manual-training high schools should become apprentice schools. But in this case the curriculum should be one so far liberalized that the history and geography of the trades connect the apprentice's skill with the social and physical conditions out of which it has sprung, and in which it at present exists. The curriculum should also contain the study of the social community into which the graduated apprentice will go. He should comprehend the central and state government not only, but the legal and administrative features of the city within which he is to labor. He should understand the laws that protect him as well as those which threaten him with pains and penalties. He must know to what officials he can appeal and he should have some comprehension of operation of the courts and the city council. He should know something of the conditions which control wages and their relation to the calling he expects to exercise. If his years and interests admit, such a course should be one in elementary sociology, such as are already to be found in French industrial secondary schools, in which the ideas of social obligations, the meaning of social standards, and the relations of man to the community can be discussed. What the child expects to do and what he expects to be provides adequate motive power for study and application. They provide also the natural center from which his relation to the past, in history, and to the present, in the study of society, can be brought within his field of interest and comprehension and through which he can form those fundamental conceptions of social rights and obligations which constitute our morality.

There remains, however, the still more difficult question of the elementary schools, where at the present time the vast majority of Americans get all their formal education. As has been indicated earlier the rest of the community have suffered

because the curriculum of the elementary schools has been fashioned to meet the demands of a commercial class, and for those who expect to pursue literary and professional studies. The arithmetics do not present the type of problem that the average child meets when he leaves school. The histories instead of bearing on the occupation and phenomena with which the child is familiar, and toward which he is attracted, are hopelessly political. One would assume, from the study of our school histories, that politics is the only phase of human society that has a history. Geography is abstracted from the actual relations of industry and commerce which would give it meaning to the child living in a world that is given over to the production of wealth.

How the elementary schools will finally adjust themselves to an education that faces toward the occupations which its pupils will enter, remains to be seen. It is, however, beyond question that the training on the farm and in the shop, even of the child who is not yet old enough to enter upon definite apprenticeship, indicates the direction toward which educational theory and practice must turn.

Two great facts stand out. One is that we are forced to reconstruct our whole apprenticeship training, and that when this is satisfactorily accomplished it will carry with it not only satisfactory technical training but a much broader and more liberal education than our schools at present can give to those who enter industrial occupations. The other is that apprenticeship provides an adequate and indeed almost the only adequate method of instructing children. When we recognize that this instruction need not be narrow nor unenlightened the objection to the application of the principle in our public schools finally disappears.